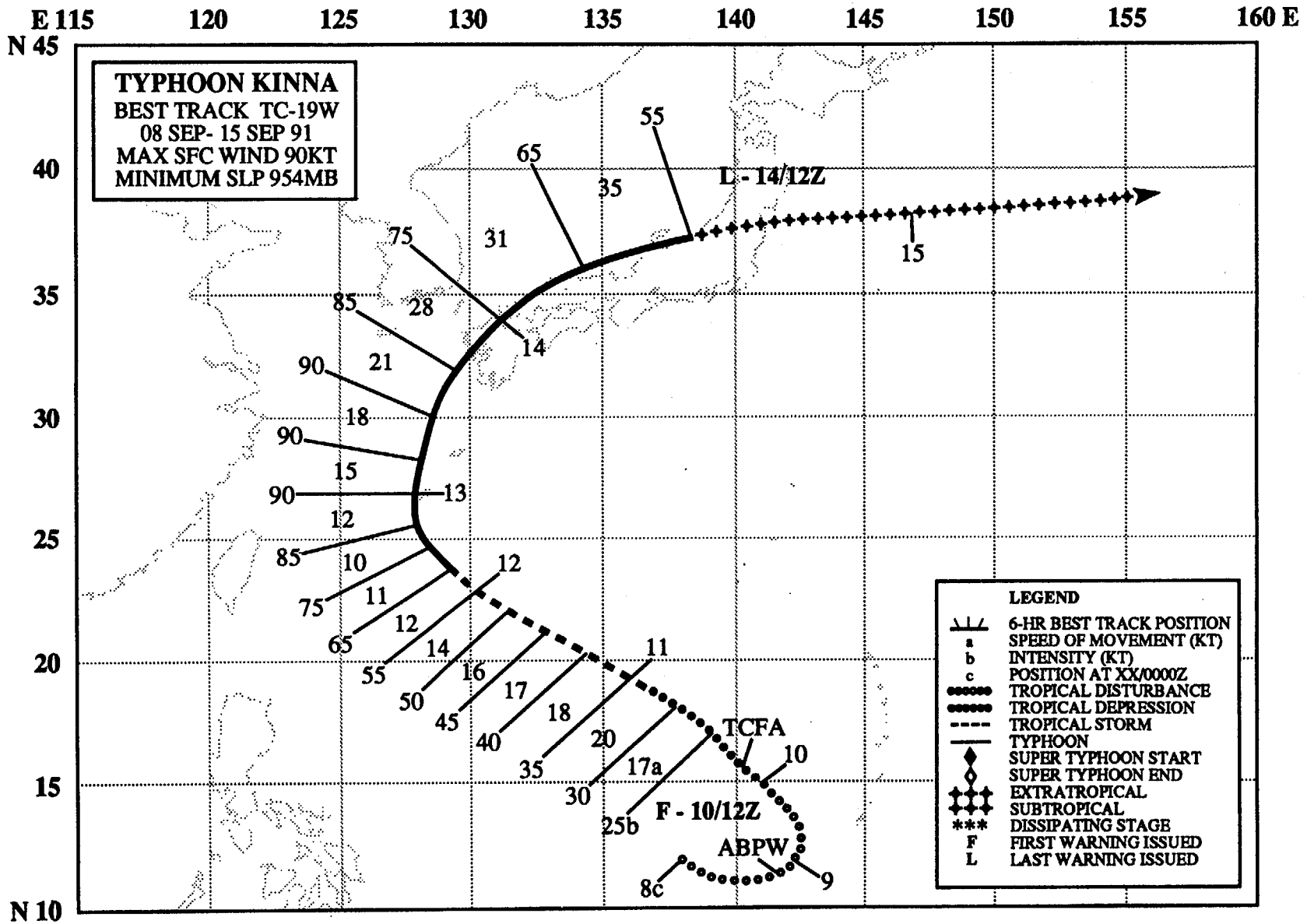
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TYPHOON KINNA
BEST TRACK TC-19W
08 SEP- 15 SEP 91
MAX SFC WIND 90KT
MINIMUM SLP 954MB
L - 14/12Z
F - 10/12Z
TCFA
ABPW
LEGEND
6-HR BEST TRACK POSITION
a SPEED OF MOVEMENT (KT)
b INTENSITY (KT)
c POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
SUBTROPICAL
*** DISSIPATING STAGE
F FIRST WARNING ISSUED
L LAST WARNING ISSUED

86

TYPHOON KINNA (19W)

I. HIGHLIGHTS

Kinna was the most destructive tropical cyclone to strike Okinawa since 1987, and the first typhoon to pass directly across the island since Vera in 1986. The typhoon also passed directly across Sasebo, Japan, and caused extensive damage on Kyushu and Honshu as it raced northeastward after recurvature. The exceptionally accurate forecasts of the path taken by Typhoon Kinna provided more than ample lead time for disaster preparation at key DOD installations.

II. TRACK AND INTENSITY

Kinna formed in the western Caroline Islands in the monsoon trough which extended across the Philippine Sea in early September. On 8 September, analysis of synoptic data revealed that a circulation was developing southwest of Guam. When satellite imagery showed an increase in convection near the circulation center, the Significant Tropical Weather Advisory was reissued at 081800Z to include the disturbance as an area with fair potential for tropical cyclone development. As the area of deep convection moved west of Guam and showed signs of increased organization, a Tropical Cyclone Formation Alert was issued at 100400Z. The first warning on Tropical Depression 19W was at 101200Z. Kinna's northwestward motion on 10 and 11 September was a reflection of a weak subtropical ridge north of the system which extended along 25°N latitude. The weak ridge allowed Kinna (Figure 3-19-1) to gain latitude as it intensified. At 120600Z, the presence of a poorly

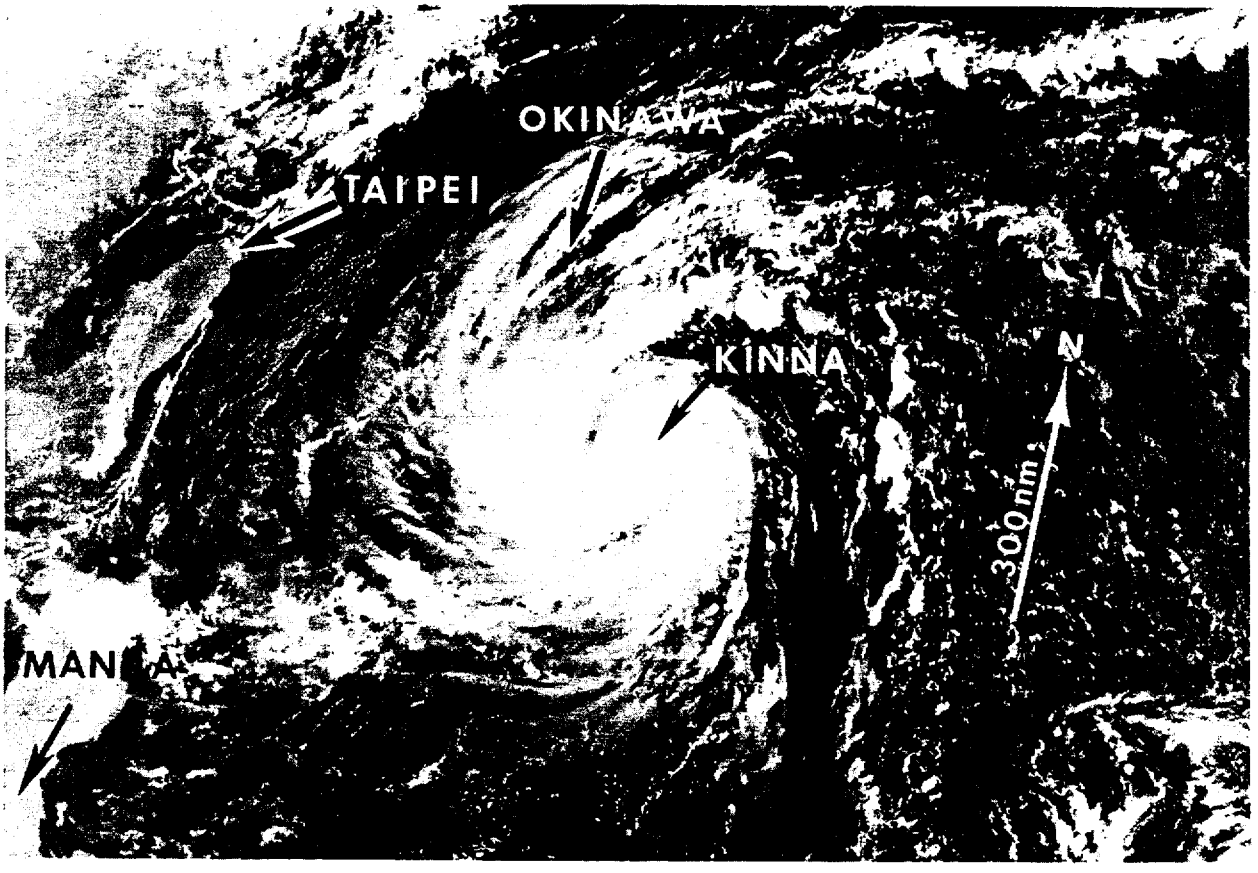

Figure 3-19-1. Typhoon Kinna intensifies as it heads for Okinawa, Japan (120004Z September DMSP visual imagery).

defined eye in the central dense overcast prompted an upgrade of Kinna to typhoon intensity.

On 12 September, a mid-tropospheric trough deepened in the East China Sea and split the weak ridge near 125°E longitude. In response, Typhoon Kinna turned northward toward the break in the ridge and tracked across Okinawa. The eye crossed densely populated southern Okinawa, with a minimum surface pressure of 958 mb recorded at Kadena AB (WMO 47931) (Figure 3-19-2). The wind recorder chart from Futenma MCAS (WMO 47933) graphically describes the three hour passage of the eye across the station (Figure 3-19-3). On Okinawa, the peak wind gust observed at Futenma MCAS (WMO 47933) was 96 kt (49 m/sec) with 82 kt (42 m/sec) at Kadena AB, and 95 kt (49 m/sec) at Naha. After recurvature, Kinna accelerated north-northeastward toward Kyushu and maintained its intensity. It's eye wall passed over the cities of Nagasaki and Sasebo on Kyushu on the 13th, with peak wind gusts of 100 kt (51 m/sec) recorded at Metabaru (WMO 47860), located 45 nm (85 km) northeast of Nagasaki. Kinna continued to accelerate due to deep mid-tropospheric westerly flow, and rapidly transitioned into an extratropical low as it tracked along the northern coast of Honshu. The final warning was issued at 141200Z.

III. FORECAST PERFORMANCE

After opting for a recurvature track on the third warning at 111800Z, forecasters correctly identified the major changes that would occur in the subtropical ridge as the short wave trough moved off of Asia. JTWC forecasters accurately predicted that Kinna would strike Okinawa, Sasebo (on Kyushu), and later skirt the northern coast of Honshu. Starting with the fourth warning issued at 120000Z, JTWC stayed with this forecast track (Figure 3-19-4). As a consequence, JTWC's performance was substantially better than its objective aids, primarily because the forecast guidance was much slower than Kinna's actual forward motion. Forecasters relied heavily on persistence for speed guidance as Kinna approached the point of recurvature and then began to accelerate. Although JTWC had a good handle on the path the typhoon would take, the greatest forecast problem was the amount of acceleration to expect as Kinna underwent extratropical transition.

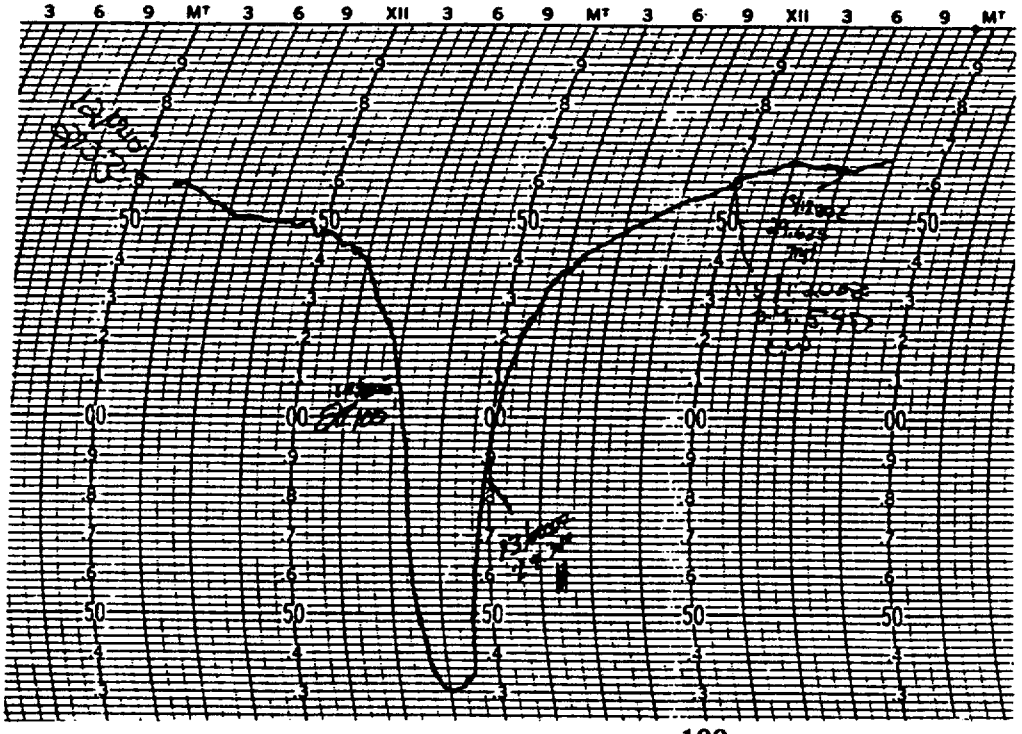

Figure 3-19-2. Microbarograph trace of surface pressure in inches of mercury recorded at Kadena AB, Japan during Kinna's passage. The minimum 28.30 at 122100Z September equates to 958 mb.

IV. IMPACT

As a result of the accurate warnings, preparations to limit the amount of damage on Okinawa and to sortie ships in the path of the typhoon were made well in advance of Kinna's approach. Despite the strong winds, damage to military installations on Okinawa and at Sasebo was minimal. Nine deaths and 65 injuries were attributed to Typhoon Kinna in Japan and on Okinawa. Most of the damage occurred on Kyushu near Nagasaki and on western Honshu. Press reports indicated 158 houses collapsed, more than 2,733 were flooded, and nearly 500,000 households were without power. The eight inches of rain which fell on Okinawa in a 24-hour period during Kinna's passage eased the island's drought conditions, and temporarily eliminated water rationing.

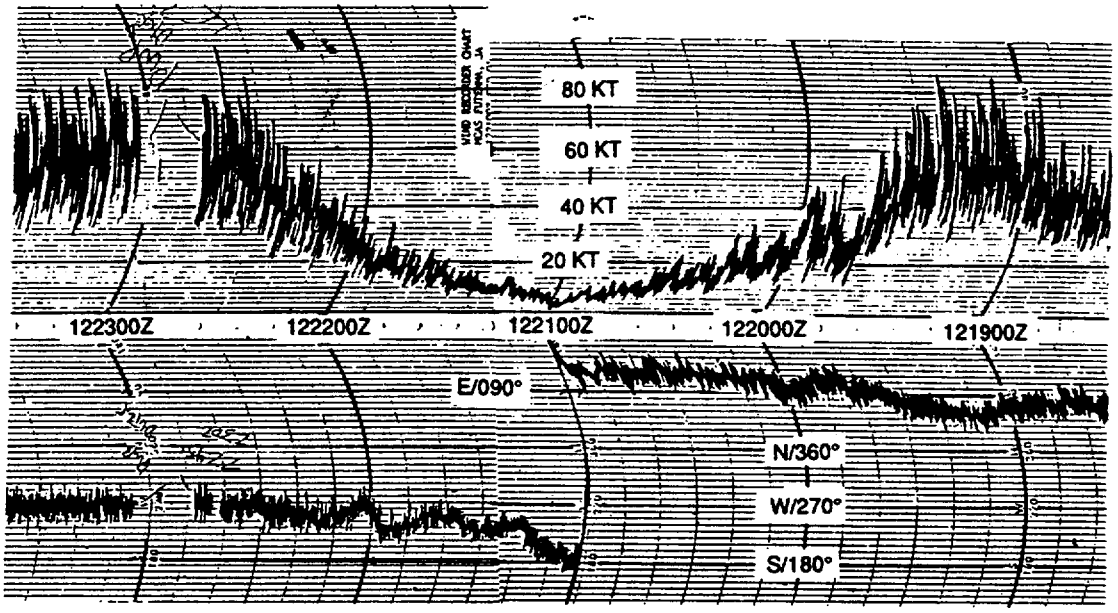

Figure 3-19-3. Futenma MCAS (WMO 47933), Okinawa, Japan, wind recorder chart reflects the three hour passage of Kinna's eye across the station.

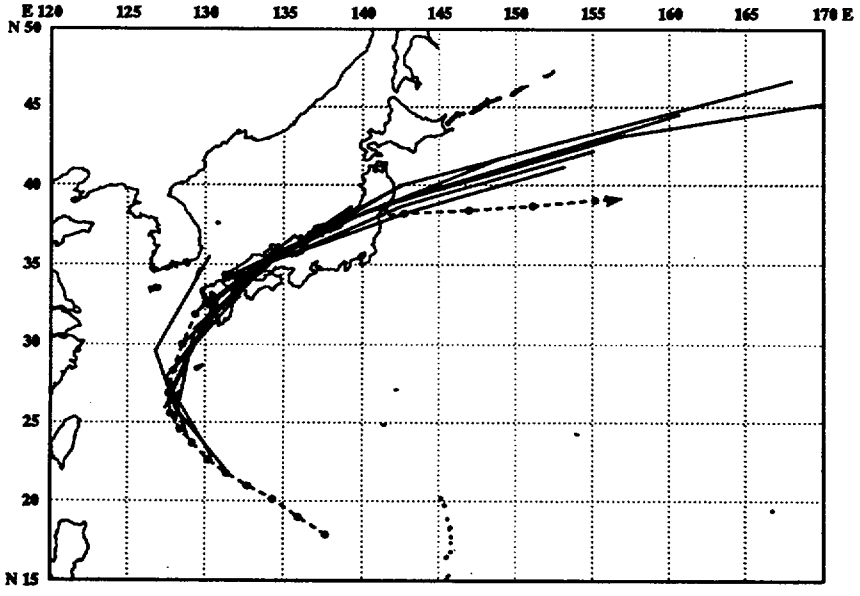

Figure 3-19-4. Comparison of JTWC forecasts issued from 120000Z to 140000Z September to the best track of Typhoon Kinna. JTWC forecasts correctly predicted the eventual path of Kinna, but were slow to predict Kinna's acceleration across Japan.